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A Multiband Slot Antenna for GPS/WIMAX/WLAN Systems

Mrs.RamanaBoina Kalyani[1]
Assistant Professor
Department of Electronics and Communication Engineering
Vignan Institute of Technology and Science
Yadadri Bhuvanagiri-Telangana

Mr.Dhanika Srinivas[2]
Assistant Professor
Department of Electronics and Communication Engineering
Vignan Institute of Technology and Science
Yadadri Bhuvanagiri-Telangana

***Abstract*: To design an antenna that capable of working in GPS, WLAN, Wi-MAX bands. The antenna is capable of working in 4 frequency bands and for 3 applications as built in by one antenna. The miniaturization is done in various stubbed arms that two E shaped stubs and a T shaped stub designed optimistically to achieve the minimal return loss over the four bands of frequency spectrum. This antenna will increase the gain and efficiency and decrease the size requirement compare to existing system.**

***Keywords*: Minimum return loss, Gain, Efficiency.**

1. Introduction

Today's mobile communication systems demand increased bandwidth for voice and data applications. Also with most systems supporting multiple wireless standards it is imperative to employ antennas which can cover these bands. Multiband antennas cater to these needs by radiating at specific discrete frequencies only. However, primary design constraints of such antennas include maintaining gain and radiation pattern purity over different frequencies. A large number of research papers have been focused on designing multiband antennas of which the most popular techniques are etching slots on the radiating patch or the ground plane. Care has to be taken while etching slots on the patch as it reduces the effective radiation aperture resulting in lower gain values. Stacking of patch is another common technique to introduce multiple bands but at the cost of increase real estate.

2. Literature survey

A low profile high isolation MIMO antenna is used for widening base station applications. Four elements with a frequency range are selected according to the frequency and are selected [1]. The WLAN and Wi-Max applications can be combined simultaneously in a single device using triple-band operation technique [2]. The microstrip patch antenna uses step slots and square ring slots with wide bandwidth and minimal return loss used for UWB applications [3]. The antenna may be used for Wi-MAX applications with omni directional radiation pattern [4]. A dual-band monopole antenna has a stem connecting to two branches that are used to generate two frequency bands The reflection coefficient, radiation pattern, and efficiency of the antenna are studied [5]. This slot antenna uses only two ranges of frequencies without switching the applications within [6]. Multi frequency circular slot antenna with metallic strips is used by operating frequencies without increasing the overall antenna area [7]. A dual-band antenna is presented by analyzing the cut-off frequencies where two proper modes are selected for the antenna designed for dual-frequency operations [8]. A U-shaped patch antenna with two arms is presented just under the U-shaped patch where the effect of size and shape is studied [9]. Two common bands are generally used in wireless applications. To remove the problem of mismatching the matching performance is studied. The gain and bandwidth are studied and performance of the proposed antenna is analyzed [10].

3. Existing antenna systems

Antennas that are used before are capable of working in the particular frequency applications. Where quarter wavelength radiators used are subjected to miniaturization which affects to form limited bandwidth and low radiation efficiency.

Drawbacks:

Each individual device use single patch antenna, so there will be high return loss.

4. Proposed antenna system

It is capable of working in 4 frequency bands and for 3 applications as built in by one antenna. The miniaturization is done in various stubbed arms that two E shaped stubs and a T shaped stub designed optimistically to achieve the minimal return loss over the four bands of frequency spectrum. Such as,

- 1.575-1.665GHz GPS
- 2.4-2.545GHz IEEE 802.11b&g WLAN
- 3.27-3.97GHz Wi-MAX
- 5.17-5.93GHz IEEE 802.11a WLAN

5. Design process

The multi band slot antenna process consist of source selection which is used to select the size and material of the antenna to be used. The frequency band is used to select the applications like Wi-MAX/WLAN/GPS. The reflective coefficient calculation will calculate the range of the frequency access to the applications. The mesh array design will have used to design the antenna in the HFSS software which consist of

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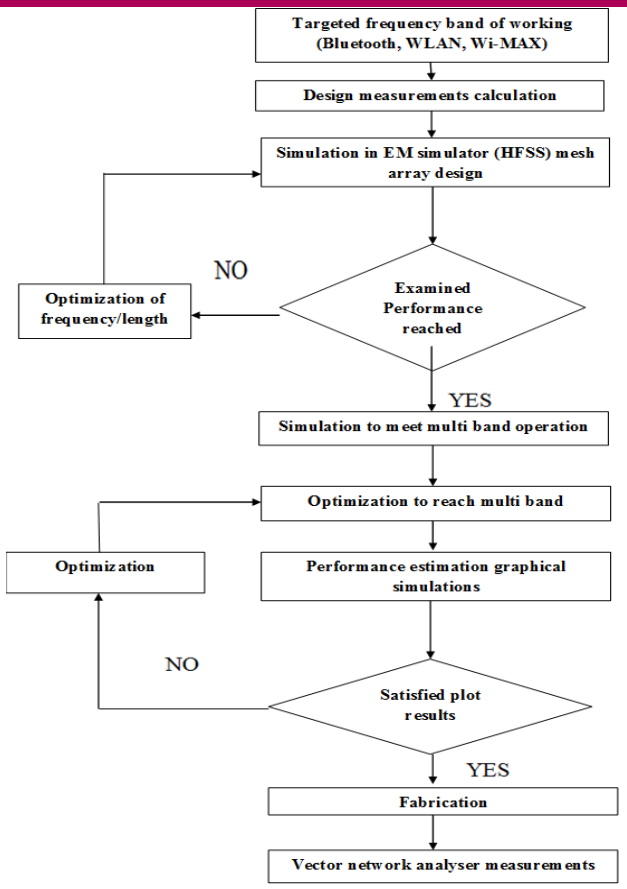

Fig. 2. Design flow

XYZ axis. The final modelling and simulation of antenna is used to analyze the design. The analyze consist of boundaries and excitations, the boundary is used to apply electric field and excitations is used to give input to the port. The output of the multi band slot antenna is shown in above figure. Using the output, we can find the range of the frequency to access the applications. The range can be detected when the frequency is below -10db it can be used for the applications. By using the frequency range the applications like Wi-MAX/WLAN/GPS can be used in the antennas. So the antenna will have multiband capability and the return loss will be low. By using the air box the radiating frequency can be checked, the antenna is placed inside the air box.

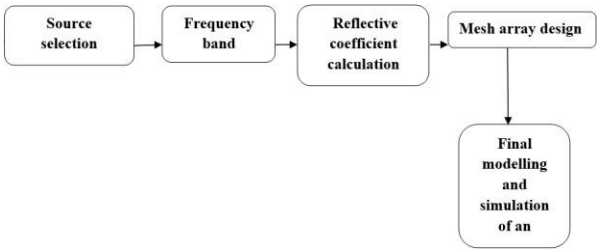

Fig. 1. Block diagram

Table 1
Dimension details

Dimensions	Length	Width
Substrate	95.66 mm	112.16 mm
Patch	27.83 mm	36.08 mm
Ground	95.66 mm	112.16 mm

6. Results and Discussion

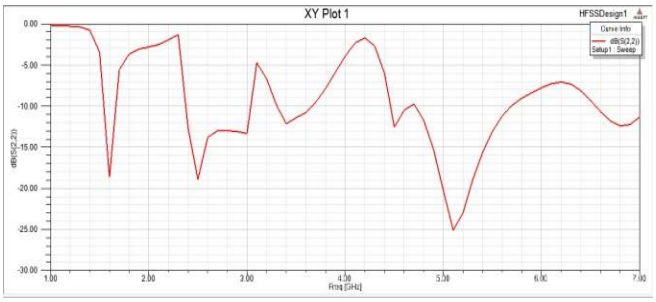

Fig. 3. Result

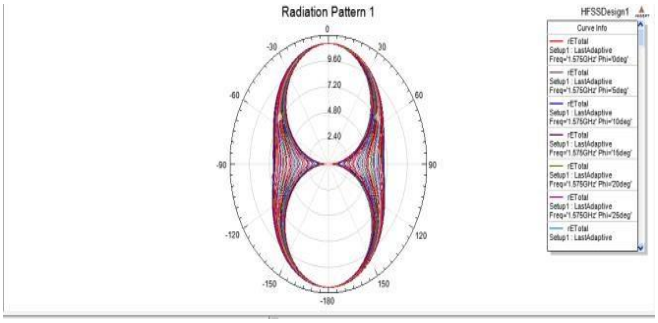

Fig. 4. Radiation pattern

The result and radiation pattern is shown in the fig. 3 and 4. The spikes appearing below 10db are the frequencies that can be used for the applications like WLAN, Wi-Max, GPS, etc. based on the frequency range.

7. Conclusion and Future scope

This technology is based on giving efficiency to multiband applications by changing the frequency and spectrum band for the required applications like GPS, WLAN, Wi-Max. Instead of using multiple antennas for individual applications, we can use a single antenna, by changing its frequencies and the delay time decreases and efficiency increases. We can come to the conclusion that our project is used to reduce the usage of antennas in various applications and vehicles to improve the efficiency of the antennas and the network coverage by changing the frequency and selecting the frequency and spectrum band. By using this antenna, we will be able to provide enhanced throughput and improved efficiency.

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Author's Biographies

First Author: **Ramana Boina Kalyani, M.Tech (Embedded systems)**
Assistant Professor

Second Author: Dhanika Srinivas, M.Tech(VLSISD)
Assistant Professor